EURO VI
Technologies & Strategies

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Commercial training
The entering into force of the new Euro VI normative provides a stimulus for Iveco to update the engine offer pursuing the logic of technological improvement.
Euro VI: pollutants

- PARTICULATE MATTER (PM)
- NITROGEN OXIDES (NOx)
PM AND NO\textsubscript{x} HAVE CONFLICTING CHEMICAL FACTORS

NO DIESEL ENGINE CAN MEET BOTH STANDARDS WITHOUT THE USE OF AFTER-TREATMENT SYSTEMS
Euro VI: normative timeline

Emission Limits

<table>
<thead>
<tr>
<th>Emission</th>
<th>Euro IV</th>
<th>Euro V</th>
<th>Euro VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>(g/kWh)</td>
<td>CO</td>
<td>HC</td>
<td>NO\textsubscript{x}</td>
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<tr>
<td></td>
<td>1.5</td>
<td>0.46</td>
<td>3.5</td>
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- EURO V ENGINES CAN BE SOLD THROUGH TO 31.12.2013

BH: NEW TYPE APPROVALS
NR: NEW VEHICLE REGISTRATIONS

CO: CARBON MONOXIDE
HC: UNBURNED HYDROCARBONS
NO\textsubscript{x}: NITROGEN OXIDES
PM: PARTICULATE
PN: PARTICLES
Euro VI: target

High **Performance** engine. **Power** and **Efficiency**...

...in harmony with the tighter **Euro VI standards** for particulate (PM) and nitrogen oxides (NOx)
Euro VI: emissions reduction

- SCR: Selective Catalytic Reduction
- EGR: Exhaust Gas Recirculation
Euro VI on all ranges

SCR+EGR

HI-eSCR
Euro VI: Iveco strategy for Medium & Heavy Range

- **HI-eSCR**: NEW FPT INDUSTRIAL PATENT
- **COMMON RAIL**: INTRODUCTION ON ALL RANGE TO IMPROVE PERFORMANCES, NVH* AND CONSUMPTION
  - OPTIMISATION OF COMBUSTION TO REDUCE NO\textsubscript{X} & PM
- **NO EGR**
- **NO ACTIVE DPF REGENERATION**

**AFTERTREATMENT STRATEGY**

IMPROVED SCR PERFORMANCES TO ENSURE MORE THAN 95% EFFICIENCY FOR NO\textsubscript{X} CONVERSION

**ENGINE STRATEGY**

OPTIMISATION OF THE COMBUSTION PROCESS TO ENHANCE POWER AND PERFORMANCES WITHOUT COMPROMISING EFFICIENCY

*NVH: Noise Vibration Harshness*
Euro VI: Hi-eSCR vs. Competitors

**HI-eSCR: EURO VI LIMITS ACHIEVED ONLY WITH SCR**

- **EGR**
  - High level of PM for exhaust gas recirculation
  - Active regeneration of DPF is required to eliminate accumulated particulate
  - Higher fuel consumption (+3% on average)
  - Recirculation gas cooling system is required
  - Lower efficiency of SCR (~80% / 85%)
  - More complex turbo layout

- **Hi-eSCR**
  - Optimisation of combustion to reduce PM emissions thanks to higher temperature
  - Passive and continuous regeneration of DPF
  - Fuel consumption in line with Euro V
  - Exhaust gas cooling system not necessary
  - Higher performances without increasing turbo complexity
  - High efficiency of SCR (>95%)

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**Competitors’ strategy**

**FPT engine strategy**
Euro VI: Hi-eSCR operating principle

Hi-eSCR

**NOx**  **PM**  **HC**  **CO**

DOC
NO → NO2
HC OXIDATION
CO OXIDATION (PM OXIDATION)

PASSIVE DPF
PM OXIDATION WITH NO2
(PM OXIDATION WITH O2 IN CASE OF A SERVICE REGENERATION)

UREA INJECTION
THERMOLYSIS
UREA → HNCO + NH3

SCR
HNCO → NH3
(NOx REDUCTION BY NH3)

CUC
NH3 reduction

NH3 SENSOR

CO2  N2  H2O

H2O
**IVECO Euro VI: Hi-eSCR customer benefits**

**FPT INDUSTRIAL / IVECO HI-eSCR**
is the only Euro VI-compliant system with SCR only

| 1 | SCR-ONLY AFTER-TREATMENT | LEAN ENGINEERING |
| 2 | NO EXHAUST GAS RECIRCULATION | COMPACT, LIGHT, EASY-TO-MAINTAIN PACKAGE |
| 3 | LESS SOOT IN DPF | NO COMBUSTION PRODUCTS BACK INTO CYLINDER |
| 4 | NO EFFICIENCY LOSS | NO ADDITIONAL COOLING REQUIREMENTS |

- **Long Drain Intervals**
- **Passive DPF regeneration**
- **More power & torque density**
- **Lower specific fuel consumption** [g/kWh]

**Body Builders**
IVECO Euro VI: Hi-eSCR

FIRST IN THE WORLD TO ADOPT THIS TECHNOLOGY
Euro VI: Iveco strategy for Light Range

- **IMPROVED COMMON RAIL:** For higher combustion process efficiency
- **NEW AFTER TREATMENT SYSTEM:** Includes for the first time the Selective Catalytic Reduction (SCR)

### Euro V
- **Common Rail:** Up to 1800 bar
- **Air Handling:** VGT / 2stT
- **ecEGR:** Exhaust Gas Recirculation
- **DOC + DPF:** Diesel Oxidation Catalyst, Diesel Particulate Filter

### Euro VI
- **Common Rail:** Up to 2000 bar
- **Air Handling:** WG / VGT
- **ecEGR:** Exhaust Gas Recirculation
- **DOC + DPF:** Diesel Oxidation Catalyst, Diesel Particulate Filter
- **SCR + CUC:** Selective Catalytic Reduction Clean-Up Catalyst

Performance, Reliability, Fuel Economy, Packaging Compactness, Ease of Installation, Operating Costs
**External Cooled EGR (ecEGR)**

F1C Euro VI is featured with an external cooled EGR systems for the “in-cylinder” NOx reduction.

- **Electronically controlled:** correct amount of exhaust gases to be recirculated
- **Reduction of NO\textsubscript{x} formation**
- **Cooling system** to reduce exhaust gas temperature
- **Drawback:** increasing PM production
Euro VI: After treatment system for F1C

DELTA VS. EURO V

FUNCTIONAL CHARACTERISTICS:

- Very good **low temperature performance** of SCR catalyst
- Dosing system **accuracy** to limit NH3 slip
- **NOx conversion ~ 90%** in the whole operating speed and load range, both in steady-state and transient conditions

BENEFITS

- LEAN LAYOUT AND COMPACT DESIGN
- EASY INTEGRATION ON VEHICLE
- LOW OPERATING COSTS

**DOC**  **DPF**

CLOSE-COUPLE DPF

**Urea Dosing Module**

**SCR**

**CUC**
IVECO Euro VI Light range: customer benefits

FPT INDUSTRIAL / IVECO
ecEGR + DOC + DPF + SCR

1. COMPACT SOLUTION
   - EGR implementation allows to save weight, space and carrying capacity on the vehicle

2. COST EFFECTIVE SOLUTION
   - NO\textsubscript{X} reduction done with EGR & SCR allows to have a smaller muffler, reduced cost

3. LOW OPERATING COST
   - Lower ADBlue consumption
Euro VI on all ranges

SCR+EGR

Hi-eSCR
Back up
Euro VI: NO\textsubscript{X} vs. PM

A-SPEED 10\% LOAD

**SIGNIFICANTLY REDUCED POWER**

**VERY HIGH FUEL CONSUMPTION**

**EURO VI LIMITS CANNOT BE ACHIEVED WITH EGR ONLY**